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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/727,451	12/03/2003	Peter J. Hopper	100-18010 (P05268-D01)	7097

33402 7590 07/27/2005

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EXAMINER
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NGUYEN, HA T

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

<b>Office Action Summary</b>	<b>Application No.</b> 10/727,451	<b>Applicant(s)</b> HOPPER ET AL.	
	<b>Examiner</b> Ha T. Nguyen	<b>Art Unit</b> 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☐ Claim(s) \_\_\_\_ is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14-20, 33-37, 39-46 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____  |

## DETAILED ACTION

### *Notice to applicant*

1. In view of new art found the allowability of claims 14-20, 33-37, and 39-46 has been withdrawn.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(a) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 14-16, 33-37, and 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (USPN 5741741) in view of Inohara et al. (USPN 5976972, hereinafter "Inohara").

Referring to Figs. 2-10 and related text, Tseng discloses [Re claim 14] a method of forming a semiconductor device, the method comprising the steps of: forming a layer of insulation material 16 over a semiconductor substrate 10 (see col. 1, lines 6-12), the layer of insulation material having a top surface, the semiconductor substrate having a top surface; etching the layer of insulation material to form a plurality of trenches in the layer of insulation material, each trench having a depth measured normal to the top surface of the substrate, a width,

and a length, directions associated with the depth, width, and length being orthogonal to each other, the top surface of the layer of insulation material having a trench region that lies between adjacent trenches in the layer of insulation material, each trench having a bottom surface vertically spaced a first distance apart from the top surface (see Fig. 3); and etching the layer of insulation material and the plurality of trenches to lower the top surface of the layer of insulation material in the trench region to form a trench surface that lies below and parallel to the top surface of the layer of insulation material, and to lower the bottom surface of each trench to form a lowered bottom surface that is vertically spaced a second distance apart from the top surface of the layer of insulation material, the second distance being greater than the first distance (see Figs 5-7); [Re claim 15] wherein the step of etching the layer of insulation material and the plurality of trenches includes the steps of: forming a layer of masking material 20' on the layer of insulation material; patterning the layer of masking material to expose a portion of the top surface of the layer of insulation material and the plurality of trenches; and anisotropically etching the layer of insulation material and the plurality of trenches (see col. 6, lines 3-52); [Re claim 16] and further comprising the steps of; forming a layer of conductive material 30 on the layer of insulation material, the layer of conductive material filling up the trenches; and planarizing the layer of conductive material to form a conductive region, the conductive region having a top surface that is substantially planar with the top surface of the layer of insulation material, the conductive region in the trenches forming a plurality of bottom fingers with bottom surfaces that lie parallel to the top surface of the layer of insulation material (see Fig. 10). But Tseng fails to disclose expressly a length that is many times greater than the width. However, the missing limitation is well known in the art because discloses this feature (see Fig. 9A-9B). A person of ordinary skill is motivated to modify Tseng with Inohara to obtain better contact between two levels of wiring thereby increasing the speed of signal transferred .

[Re claim 33] Tseng discloses wherein the lowered bottom surface exposes a nonconductive material (see Figs. 6-7, before the bottom surface reach the layer 12);

[Re claim 36] wherein the conductive material is a top surface of a contact 12;

[Re claim 35] It would have been obvious that the conductive material is a top surface of a via, when the connection is done to wiring of an additional level.

[Re claims 34 and 39] Inohara discloses wherein the bottom surface exposes a conductive material, an exposed area of the nonconductive material being substantially greater than an exposed area of the conductive material (see Fig. 9A-9B). The examiner interpreted that depending on the size of the contact hole more or less of nonconductive material would be exposed.

[Re claim 37] forming a conductive layer on the layer of insulation material, the conductive layer filling up the trenches; and planarizing the conductive layer to form a conductive region, the conductive region having a top surface that is substantially planar with the top surface of the material, the conductive region in the trenches forming a plurality of bottom fingers with bottom surfaces that lie parallel to the top surface of the layer of insulation material, as shown in the rejection of claim 16.

[Re claim 40] Tseng discloses wherein the plurality of trenches lies substantially parallel to each other (see Figs.) ; [Re claims 41 and 42] the arguments used for the rejection of claims 35-36 also apply.

Therefore, it would have been obvious to combine Tseng with Inohara to obtain the invention as specified in claims 14-16, 33-37, and 39-42.

4. Claims 18-19 and 43-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng in view of Inohara, as applied above, and further in view of Chittipeddi et al. (USPN 6417087, hereinafter "Chittipeddi").

The combined teaching of Tseng and Inohara discloses substantially the limitations of claims 18-19 and 43-45, as shown above.

But it fails to disclose expressly wherein a top surface of a single contact is directly connected to the bottom surfaces of the plurality of bottom fingers; wherein a top surface of a single via is directly connected to the bottom surfaces of the plurality of bottom fingers.

However, the missing limitation is well known in the art because Chittipeddi discloses top surface of a single contact is directly connected to the bottom surfaces of the plurality of bottom fingers (See Fig. 2 ). Besides, if needed the connection is done directly to a via.

A person of ordinary skill is motivated to modify Tseng and Inohara with Chittipeddi to reduce stress.

Therefore, it would have been obvious to combine Tseng and Inohara with Chittipeddi to obtain the invention as specified in claims 18-19 and 43-45.

5. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng in view of Inohara, as applied above, and further in view of Adams et al. (USPN 6566242, hereinafter "Adams").

The combined teaching of Tseng and Inohara discloses substantially the limitations of claim 20, as shown above. It also discloses wherein the layer of conductive material includes a barrier layer formed on the layer of insulation material; and a layer of copper formed on the layer of barrier material (see col. 7, lines 37-47).

But it fails to disclose expressly a layer of seed material being formed on the layer of barrier material.

However, the missing limitation is well known in the art because Adams discloses this feature (See col. 9, lines 58-65).

A person of ordinary skill is motivated to modify Tseng and Inohara with Adams to form reliable Cu interconnect at a low cost.

Therefore, it would have been obvious to combine Tseng and Inohara with Adams to obtain the invention as specified in claim 20 .

6. Claims 17 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng in view of Inohara or Tseng in view of Inohara and Chittipedi, as applied above, and further in view of Yu et al. (USPN 5952704).

The combined teaching of Tseng and Inohara or Tseng, Inohara and Chittipedi discloses substantially the limitations of claims 17 and 46, as shown above.

But it does not disclose expressly wherein the conductive region is formed to have a number of loops; wherein the loops lie substantially in a same plane; the loops being electrically connected together.

However, the missing limitations are well known in the art because Yu discloses these features (See Figs. 1-5).

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A person of ordinary skill is motivated to modify Tseng and Inohara or Tseng, Inohara and Chittipedi with Yu to obtain an inductive wiring with reduce parasitic capacitance (see Yu, abstract).

Therefore, at the time the invention was made, it would have been obvious to combine Tseng and Inohara or Tseng, Inohara and Chittipedi with Yu to obtain the invention as specified in claims 17 and 46.

### *Conclusion*

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Ha Nguyen  
Primary Examiner  
07-18- 05